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The Lender of Last Resort Function Under a Currency Board

The Case of Argentina

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No grand solution appears to exist for the problems that seem inevitable in the Argentine system, in which the Central Bank is both lender of last resort and currency board, providing full convertibility between pesos and U.S. dollars. Argentina's strategy therefore must turn on actively strengthening its banking systems to reduce solvency risks and on building its reserves.



Summary findings

Within the current rules of the game, Argentina's central bank (BCRA) is charged with being the lender of last resort as well as providing full convertibility between pesos and U.S. dollars — two objectives with one instrument, namely, reserves. Within those rules, it may well be that the balance of responsibilities needs to shift. Complete dollarization can significantly reduce risks but not entirely eliminate them. If the BCRA can concentrate more on building up reserves and helping to ward off crises of confidence in the currency, perhaps the banking system can protect itself better from liquidity shocks. But this will require, among other things, consolidation of

the sector (which could give it greater access to outside liquidity) and prudential strengthening of the system. Triage of weaker banks should continue and not await another crisis. More experience with the new liquidity policy is needed and so is reform of the settlement system, as it affects the functioning of the interbank market, which is essential for containing crises.

Essentially, however, no grand solution seems to exist for the problems that seem inevitable in a system where the central bank is also the currency board. Argentina's strategy must therefore turn on actively strengthening its banking systems to reduce the risks of insolvency.

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The Lender of Last Resort Function Under a Currency Board The Case of Argentina

by

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I. Introduction

The role of a central bank as the lender of last resort for financial institutions has a long history. The evolution of dominant commercial banks, such as the Bank of England and other European commercial banks, from private institutions to government agencies, and the establishment of the Federal Reserve System in the United States, were strongly influenced by the perceived inability of private institutions to stop financial panics.

The analytical argument for this government function has been refined considerably in recent years. There is now widespread, but not universal, agreement that asymmetric information, which accounts for the existence of financial intermediaries, also makes them prone to self-perpetuating declines in asset values during a “panic.” Modern, fractional reserve banking systems are inherently unstable in that, although an incentive compatible regulatory framework will encourage bankers to insulate their portfolio from diversifiable risk, common shocks—systemic risks—reduce the market value of banks’ assets. Any system in which the value of bank liabilities do not also decline is viable only if a lender of last resort is willing and able to transfer wealth to depositors. This implicit liability taken on by such a lender of last resort (LOLR) can be reduced in a number of ways but not entirely eliminated. An LOLR steps in because bank failures entail economic costs related both to a breakdown of the payments system and the special role banks play in evaluating credit risks.

It is also widely accepted that the existence of a lender of last resort is itself a distortion that can reduce the probability of declines in asset values but at the cost of subsidizing private investment decisions that are inefficient and potentially very costly. The solution currently in place in industrial countries is that institutions benefiting from lender of last resort facilities are constrained both in their investment decisions and in their capital and liability structures.

While solutions other than regulation have a long history as logical arguments, there is little recent experience with how they might work in practice. The classic prescription is to do away with banks as we know them by requiring that insured institutions hold highly liquid reserves against most or all of their monetary liabilities. While these alternatives are discussed below, it should be kept in mind that attempting to operate a financial system

according to such a scheme would be a considerable step into the unknown. For this reason we focus on the traditional trade-off between insurance and regulation. The plan of the paper is as follows. In the next section we first put the issues into the Argentine context and examine the operation of the quasi-currency board in the post-tequila banking crisis of 1995. Then we turn to reviewing how other currency boards have handled the LOLR issue, and finally look at the analytics of the problem. Section III explores the risks that must be absorbed by any lender of last resort in a fractional reserve banking system, while section IV discusses the role of reserve or liquidity requirements or the option of full dollarization of the banking system. Section V considers the risks associated with changes in the exchange rate, which any fixed rate arrangement faces. The final section (VI) explores a range of policy options to augment or reduce the need for the central bank to exercise its lender of last resort function.

II. Currency boards and lenders of last resort

The Argentine Case

Argentina provides the clearest case of a quasi-currency board attempting, in the end successfully, to ward off the effects of a sharp financial shock. The events of the post-tequila crisis of December, 1994-April 1995 are described in Box 1 and can be summarized as a combination of liquidity crisis and confidence crisis which resulted in an outflow of \$8 billion in deposits in a 3-month period, equivalent to 16% of total banking system deposits.

The difficulties of the Argentine system stem first and foremost from the dual role that the Central Bank is obliged to perform: i) provide limited lender of last resort (LOLR) functions to the extent that it has excess reserves, defined as reserves over and above the necessary 1:1 backing of the currency and other monetary liabilities and (ii) provide full convertibility between pesos and US Dollars. In the early 1995 crisis, the Banco Central de la Republica Argentina (BCRA) lost \$ 4 billion in reserves. It thus came close to the margin of its own convertibility requirements.

The December 1994-April 1995 Argentine Banking Crisis

Initial Shock

- Domestic mini-crisis following failure of bond trading house shakes confidence and causes banks to cut lines to these "mayoristas."
- Tequila effect shakes confidence in LA and investors re-evaluate Argentine exposure.
- Stock and bond markets suffer large losses.
- Banks call in loans extended to dealers and provincial banks, now largely insolvent (due to earlier mismanagement).

Aftershock

- Sensing increased risks to convertibility, deposit withdrawals begin -- \$2b. in two weeks.
- Liquidity crisis forces banks to cut credit lines.
- BCRA persuades top 5 banks to provide \$250m. in safety net.
- BCRA establishes second net via reserve requirement reduction for top 25 banks, yielding \$790m.

Continuing Crisis

- Deposits fall further Jan-Mar 1995, reaching 16% reduction or \$8b.
- Interbank interest rates skyrocket.
- Dollarization increases.
- BCRA extends extraordinary liquidity assistance above limits of bank capital and for longer than 30 days, totaling \$1.7b. rediscounts and \$300m. repos.
- Some banks fail.

Freefall Stops

- International package (IMF, IBRD, IDB) plus domestic and international bond issues restore confidence.
- Strong commitment to convertibility maintained, although reserve level falls by \$5b., close to minimum possible.
- Deposit insurance (limited, privately financed) announced.
- Dual bank restructuring funds to privatize provincial banks and restructure private banks established with aid of multilateral banks.
- Fiscal strengthening plans announced.

Outcome

- Bank consolidation as 28 cooperative and 5 wholesale banks close.
- Provincial banks moribund, fifteen in process of privatization/closure.
- Top 10 private banks increase market share as deposits begin to return.
- Crisis ends with \$8b. deposit outflow having been covered by reserve loss (\$4b.), BCRA liquidity (\$2b.), loan reductions (\$1b.) and foreign loans (\$1b.).

In its role as LOLR, the BCRA was forced to provide liquidity to smaller and weaker banks and it did so to the tune of about \$ 2 billion. Much of this has been repaid, but at least \$300 million and as much as perhaps 3.5 billion is not recoverable. In addition, a total of about \$2.5 billion will have to be spent out of public coffers to finance the public provincial bank closures and privatizations, at least half financed initially by multilateral loans, and another \$500 million will be spent to help facilitate private bank mergers and acquisitions. (In addition, the public's direct losses in failed private banks, since there was no deposit insurance in effect at the time of the crisis, could be on the order of 2% of deposits or perhaps some \$ 800 million.) In total, therefore, not counting impaired portfolios but rather actual costs, the amount lost by the public directly and indirectly approaches 1.6% of GDP. This is a far smaller amount than expected and far smaller than that experienced in other banking crises (see Rojas-Suarez and Weisbrod, 1996a, Caprio and Klingebiel, 1996).

That the Argentine system is better positioned to withstand an external shock than it was in 1995 is nevertheless clear. Evidence includes the facts that: a) the worst performing public sector banks have largely been identified and are in the process of being excised from the system via privatization and/or closure actions and 15 banks are in this group; b) the worst behaving private sector banks-- including wholesale banks that were engaged in questionable lending activities are mostly bankrupt and out of business and cooperative banks have been merged and are, at least according to the Superintendency of Banks, stronger banks as a result; c) limited, private deposit insurance has been instituted, covering up to \$20,000 in total deposits and this is apt to make future bank closures utilizing the BCRA's powers to segregate assets and liabilities of intervened banks granted under Article 35 bis of the revised Law of Financial Entities more likely in any future crisis; d) the concentration of deposits in larger banks means that the BCRA may be faced with a smaller liquidity problem in the future if the confidence in smaller banks is impaired; and e) both the BCRA and the Superintendency have learned on the job how to function in a systemic crisis of major proportions.

The difficulty remains, however, that banking crises in Argentina are hard to isolate and that systemic crises, even if they do not affect all banking segments equally, are apt to risk both bank solvency and ultimately convertibility itself. Hence the search for alternatives to the

limited LOLR ability of the Argentine Central Bank (Pou, 1995). Rojas-Suarez and Weisbrod (1995a) show the volatility of interest rate changes, which of course serves to reduce the value of existing assets of banks and drive illiquid banks to insolvency, are higher in the case of Latin American banking crises, which may complicate distinguishing solvency and liquidity problems. This phenomenon may well be related to the finding by Caprio and Klingebiel (1996) that Latin American banking crises in the 1980s were more likely preceded by rapid real credit growth, well in excess of the pace of real GDP growth, compared with bank insolvency elsewhere.

Recent developments which affect the necessity of utilizing LOLR functions in the BCRA are worth noting. First, the BCRA has abandoned reserve requirements in favor of a liquidity policy and has eliminated distinctions between demand and other deposits. An across the board 15% liquidity policy is in effect for all deposits less than 90 days tenor. Second, there is now greater choice of legally acceptable liquidity instruments, including the ability to hold liquidity requirements in deposits in foreign banks, in OECD country government issues, and in other approved assets, among them new government of Argentina issues. The net result has been an increase in liquidity holdings -- a change in preferences in favor of lower risk assets -- of banks in many cases above the minimum required by the BCRA. Indeed, this has caused a drop in lending as banks find the combination of security and return attractive. One implication, however, is that banks are taking an increasingly independent responsibility for their own liquidity needs, and implicitly relying less on the limited LOLR powers of the quasi-currency board.

The final observation on the current condition of the Argentine banking sector concerns the consolidation in the number of banks and the increased concentration of deposits in the larger banks. The number of Argentine banks, which totaled some 200 two years ago, stood at 168 before the crisis, at 143 six months after the crisis and is 124 in early 1996. Independent estimates by bank analysts indicate that only about half of these are expected to remain in a 3-5 year period and recent interest in mergers and acquisitions bears this out. Size will be an important determinant of survivability in Argentine banking, which has some implications for the sharing of liquidity risk between the private banks and the BCRA. In terms of deposits, between November 1994 and June 1995, the ten largest banks increased their share

of private bank deposits from 49% to 57% and this trend likely continued. Accompanying the large return in deposits during late 1995 and early 1996 has been a pronounced shift towards dollar denominated deposits. For example, of the \$ 3.3 billion increase in deposits between July 1995 and December 1995, some \$ 2.6 billion was in US Dollar-denominated accounts.

Nevertheless, despite banking system strengthening, a risk-adjusted capital asset requirement of 11.5%, and improved supervision, the Argentine system has had to deal with the after-effects of the crisis in a climate of recession. Growth in 1995 was negative 3.5% and the quality of the loan portfolios of banks has suffered as a result. Recent estimates by the BCRA (Bulletin of Monetary and Financial Affairs, Nov.-Dec. 1995) point to a ratio of unprovisioned non-performing loans equal to 26.7% of net worth of banks as of October 1995 as compared with 18.7% prior to the crisis. This may partially explain the reluctance of banks to lend and is seen in the large increase in bond holdings in the balance sheets of private banks. This can also be seen as a defensive maneuver adding to the active liquidity policy of banks and searching for ways to rely less on the limited role of the BCRA as LOLR. These issues are addressed below.

How others have coped

In the debate about the role of a LOLR in a currency board regime, a look at present and historical examples is highly appropriate, and several stand out: Hong Kong in recent years, with its own currency board; Canada, prior to the formation of a central bank in 1935; the free banking era in Scotland, roughly the 150 years up to the Peel Act of 1844; and individual U.S. states before the Federal Reserve was founded in 1914. In all of these examples, there was no explicit lender of last resort, but in many instances of crises, some LOLR appears to have emerged. If a shock is sufficiently serious, all governments appear to have been willing to step in to alleviate the burden on depositors and to stem an actual or potential run on the banking system. Although it is possible to make the system more robust, such as by banning demandable debt or allowing the market to create alternatives, legal restrictions and/or societies' preferences have limited these experiments.

The most popular example of a currency board is that of Hong Kong prior to 1972 and more recently since 1983. Although the Hong Kong Monetary Authority has not performed the LOLR function, the government did in fact step in using its substantial reserves. Significant crises—truly systemic ones—have been avoided by high concentration in banking and diversification of the banking system. Although there are a large number of banks—about 165 in 1990 -- one bank, with its subsidiaries, controlled over 90% of banking deposits and assets held by all local banks, and this one bank was significantly diversified outside Hong Kong (Freris, 1991). Thus Hong Kong's solution to the bank stability problem has been high concentration, combined with excellent diversification (not simply within Hong Kong) and the maintenance of a large stock of reserves for intervening. In the late 1980s when several small banks were in trouble, the foreign exchange assets of the Exchange Fund were about 23% greater than the total assets of all the small, local banks (that is, all local banks except the one large banking group).¹ Only a very small part of the banking system had a portfolio with significant sectoral or geographical risk concentration, and these banks were sufficiently small that they could be dealt with on a case by case basis. No bank was liquidated in the 1970s or 1980s, as, notwithstanding the authorities' free market philosophy, the Exchange Fund (which holds Hong Kong's foreign exchange reserves) was used to provide support.

Although neither pre-1935 Canada nor Scotland during its free banking era were currency boards, they were conceptually similar in that there was no central bank. However, each saw a way to maintain relatively safe banking. In Canada, nationwide diversification through unlimited branching certainly contributed to the safety of the system; during most of the 19th and 20th centuries, Canada had only 30-60 banks, and enjoyed a markedly lower failure rate (even in terms of losses per dollar of deposit) than in the United States. Nationwide branching figured prominently in most explanations of the relative stability of the Canadian system.² Canadian banking stability also was aided by double-liability laws (as in the less crisis-prone U.S. states) and high minimum capital requirements. Nonetheless, in some cases it was judged necessary for the government to intervene. In 1907, related to the panic that began among N.Y. banks, several Canadian banks were threatened, and the government stepped in to issue its own paper, *even though this likely was not legal at the time*. The 1914 Finance Act legitimized such interventions, in effect giving the Finance Ministry LOLR powers, which were used until the creation of a central bank in 1935. Notwithstanding the

ability of individual banks to issue their own notes, the need to increase the elasticity of the money supply was the prime argument for a central bank, as the LOLR functions already were present. Without a central bank, Canada was spared the policy-induced decline in the supply of money that the U.S. experienced during the 1930s, but the depth of the depression there spurred the demand for institutionalizing the capacity to expand money.

Scotland's free banking era also is instructive. From 1695 to 1844, Scotland effectively had a two-tiered system: there were three large, limited-liability banks controlling a large share of banking activity, and numerous small banks whose owners faced unlimited liability. During the first part of this period, the unlimited-liability banks negated the threat of runs by offering an option clause on their bank notes, to the effect that they promised to pay either the fixed sum on demand or 6 months later that sum plus 5% (see Kroszner, 1996, or Cowan and Kroszner, 1989). Bank runs were said to be unknown in Scotland, whereas they were common in England. To the extent that the option clause averted runs, it no doubt reflected that the deferred payment had a positive net present value. Also, the ability to issue bank notes freely, disciplined both by unlimited liability and by the threat of adverse clearings, helped to make the banking system elastic even without a central bank. When the large banks conspired to make the option clause illegal (the added attractiveness of the bank notes of the unlimited-liability banks was a competitive threat), the banking system still was safeguarded by the need for the small banks to conduct themselves prudently, and ultimately by recourse to the Bank of England.

Lastly, the case of individual U.S. states during the pre-Federal Reserve era is also relevant for countries with currency boards. Essentially there were two different regulatory regimes in place for much of U.S. history: unit banking, which prohibited any branching within states, and branch banking, which permitted within-state branching, interstate branching being forbidden. Following the closure of the Second Bank of the United States in 1837, the so-called free banking era began. Banking was significantly more robust in the states with branching, both because the banks were more diverse and fewer in number (Calomiris, 1990). Branching banks in the South survived the crises of 1837 and 1857 by coordinating temporary suspensions and resumptions of convertibility of deposits into cash.

Branching was made more robust in several states by adopting unlimited mutual liability laws for clearing house members. These laws gave bankers the incentive to monitor one another, which appeared to work quite well as long as the number of institutions remained limited;³ also in some instances, banks faced double-liability laws, which led to high capital-asset ratios and lower failure rates. Unit banking states saw significant failures during these crises, and in response they developed liability insurance schemes, all of which failed.

Each of these cases reviewed here included variations in the regulatory structure that made it less likely that a LOLR would be needed: Hong Kong features a high concentration of the banking system; in Canada, concentration plus good diversification due to the ability to branch widely in a diversified economy; in Scotland, unlimited liability on bank owners, which led to prudent risk taking; and in various U.S. states, better diversification with branching and either mutual liability among banks participating in clearing houses or double liability laws.

Thus countries with or considering adopting currency boards should institute the most robust regulatory system possible, key elements of which include diversification and incentive compatible regulation. As most developing countries are small and undiversified, limiting banks to branching within their borders will leave them with a large amount of “undiversifiable” risk. Allowing banks to branch abroad, or at least to hold a more diversified global portfolio, will reduce the scope of “undiversifiable” risk and so contribute to their ability to withstand local shocks. Additionally, raising liability limits directly, putting in place a mutual liability system, or arbitrarily boosting capital adequacy requirements well above the BIS guidelines -- a path chosen in Argentina -- would help to improve the incentive compatibility of banking. Bank concentration, which can raise the franchise value of bank licenses, also acts to encourage prudence.

However, regulatory arrangements cannot eliminate the possibility of a systemic banking crisis, because they cannot eliminate systemic risk, and indeed in Hong Kong and Canada the budget in effect became the lender of last resort. Therefore, since some risk cannot be diversified away, it is important that authorities consider how LOLR support will be provided when it is needed. Current and historical cases suggest that, when it cannot be provided by the central bank, it will come from the budget or a fund. If it is the latter, then it is crucial

that it have large resources relative to the risks faced. In the absence of these resources, swap lines with commercial banks or other external entities could fill this gap. Ultimately, however, rebuilding reserves or paying back a short term loan comes back to a fiscal commitment by the authorities, and it therefore is important that authorities recognize this feature of last resort lending when the ability to alter the stock of reserves is absent.

Analytical approaches

The underlying problem for a currency board can be thought of as a conflict between two policy objectives and one instrument. The instrument is the board's stock of international reserves. The first policy objective is convertibility of the board's domestic currency denominated liabilities into foreign exchange at an exchange rate that is "permanently" fixed. These liabilities typically include currency and commercial banks' reserves held at the currency board. In most cases we think of this as a "fixed exchange rate commitment" that appears to be credible because the Board's liabilities are backed by foreign exchange assets. The second policy objective is often implicit and is the maintenance of convertibility of some class of commercial bank deposits into currency or deposits at the currency board. We often think of this as a "lender of last resort" commitment.

Free convertibility between bank deposits and currency board deposits simply means that the private sector can exchange bank deposits for cash at a ratio of one to one. This commitment can take the form of deposit insurance, which typically covers a subset of banks' deposit liabilities, or more generally it can take the form of a commitment either to lend to banks or to purchase banks' assets at a price that maintains banks' ability to convert some class of deposits into cash at par. In either case the central bank, or more generally the government, protects depositors against losses on banks' assets that exceed the banks' capital, though this protection need not be complete, universal, or automatic.

The key economic problem behind such insurance is that banks' asset values are not independent draws from a distribution with a predictable aggregate value. Economic shocks, both those originating domestically and those from the rest of the world, can "permanently" depress the market value of all domestic assets⁴. In this event the insuring agency must have access to assets, tax receipts, lines of credit or new issues of domestic currency or bank

reserves; this final source of “credit,” money creation, is the reason lender of last resort responsibilities have typically been assumed by the central bank. Nevertheless, there is no reason in theory why the lender of last resort commitment cannot be undertaken by the home government, a foreign government, or an international institution that does not have the ability to issue new monetary liabilities.

The maintenance of convertibility between bank deposits and cash or deposits at the currency board is not a logical necessity for a currency board. In fact “orthodox” currency boards are precluded from discounting domestic assets in order to maintain their domestic currency value. The absence of such a commitment means that the market value of domestic bank deposits must reflect the market’s valuation of the foreign exchange value of banks’ capital and assets. Because bank deposits need not be convertible at par for cash, a run on banks suspected of insolvency is possible only if the bank maintains convertibility. If this is not possible either the bank is liquidated or the deposits at such banks would trade at a discount relative to cash. If all banks are suspected of insolvency, all bank deposits would trade at a discount relative to cash.⁵ In the more likely event that only some banks’ solvency is in doubt, there might be a run to safe banks if the suspected banks maintained convertibility, as has occurred in Hong Kong occasionally, but if convertibility is not maintained these banks’ deposits would then trade at a discount.

Thus it seems to follow that a LOLR is a logical necessity for the maintenance of a unified fixed exchange rate. It appears to us inconsistent to argue that a currency board system that has as its primary objective the maintenance of a fixed exchange rate can avoid a lender of last resort commitment. The commitment of a currency board to convert its own liabilities into foreign exchange may be of little practical importance in the face of declines in the market value of banks’ assets.

Banks can, for some time interval, induce the private sector to exchange cash for deposits at par by offering high interest rates relative to cash. In Estonia, for example, interest rates on bank assets and liabilities have exceeded returns on assets free of default risk for substantial time periods. But ultimately offering a higher interest rate will only increase the odds that the bank will fail⁶. At that point, depositors will demand cash and the currency board will have to allow the bank to fail or to continue to function with its liabilities trading at a

discount. In Estonia banks have been closed but losses minimized by government lending that is equivalent to a LOLR.

The rules of the game for an orthodox currency board could be that banks suspend convertibility of their deposits when depositors' demand for cash exceeds the bank's reserves. Bank deposits would then trade at a discount relative to the board's "cash" liabilities, with the discount varying with the concerns about a given bank's portfolio. This maintains the banks' important role as financial intermediaries, but such a policy defeats the main objective of the board, that is, to maintain the foreign currency value of domestic money. The policy imperative here is to protect the value of domestic currency by defending the integrity of (some of) the banks.

Price inflation in such a system can be measured by the rate of devaluation of bank deposits relative to dollars and convertible board money. Rolnick and Weber (1986) show that there are many historical examples of a good and bad currency circulating side by side for long periods of time. The claim that "bad money drives out good" is only relevant under the very unrealistic assumption that the mint, or in the modern context the central bank, follows a very naive policy of unlimited convertibility at a fixed exchange ratio. They also make the interesting point that sellers of goods and services have a strong incentive to quote (high) prices in the bad currency and offer discounts for buyers that offer to pay in the good currency. Quoting low prices in the good currency and demanding a premium for the tender of bad currency would call in to question the legal tender status of the bad money. Suspending convertibility then should be recognized as a way of increasing the flexibility of a currency board, but at the cost of compromising the commitment to control domestic price inflation. These issues are revisited below.

The credibility of any lender of last resort depends on two important considerations. First, in the event of a general decline in value of commercial banks' assets, the lender must have access to sufficient cash to meet any resulting deposit drain. Second, the lender must have an incentive to buy assets at prices that the market, at the time, considers unrealistic. This second condition explains why private insurance schemes from third parties should not be expected to be robust. At the same time, it also points out why clearinghouse associations of relatively small numbers of banks have been more successful: with relatively few players, the

threat of contagion is more real, as is the possibility of supervising members' activities. Mutual liability for losses also has worked to cement this interest (Calomiris, 1990).

Banks' deposits are typically some multiple of their reserves and so the lender of last resort commitment requires a much larger stock of official reserves as compared to a pure currency board. Since the currency board cannot issue its own monetary liabilities without the backing of foreign currency reserves, the only reliable alternative to reserves would be a line of foreign currency credit that could be automatically called upon by the board in the event that the private sector wishes to convert its bank deposits into foreign exchange.

The resources needed to provide a credible lender of last resort commitment might be reduced by restricting the issue of monetary liabilities by commercial banks and other financial intermediaries to levels fully covered by safe foreign currency assets (private reserves). These reserves could be held in each bank or by a private insurance fund. If such a fund is established, it can economize on reserves by regulating the behavior of members. But the savings are quite limited because a systemic shock hits all the banks at the same time.

The well known limitation of an effort to force banks to self insure with high reserve requirements or liquidity requirements is that such regulations necessarily reduce the profitability of banks. This, in turn, creates strong market pressure for nonbank financial intermediaries to offer close substitutes for bank deposits. When a large part of intermediation has moved into less regulated financial markets, the central bank may face an even more unstable system. Moreover, we argue in section IV that reserve requirements may not contribute to stability of a regime even if disintermediation is limited. But first the next section will look at systemic issues in modern banking systems; those familiar with these issues may wish to skip ahead to section IV.

III. Systemic risks common to modern banking systems

Familiar risks to fractional reserve banking systems include bad luck in the form of changes in international relative prices that reduce the market valuation of domestic firms and in turn the commercial banks' claims on firms, and bad economic policies that cause investors to

reevaluate the potential earnings from the domestic capital stock. A failure of market oriented reforms and excessive accumulation of government debt are examples of the latter.

Banking Sector Risks

The LOLR function of central banks was developed to ensure an elastic reserve supply as a means of responding to incipient banking panics and to reduce the chances that such panics would occur. Thus, the LOLR serves a dual role: by responding to banking crises it can limit contagion effects, while its very existence can represent a credible commitment to respond to a crisis and thereby reduce the chances that one would occur. In this section we review lessons from the literature that have shaped our understanding of the LOLR. We start by considering the sources of and consequences of banking crises.

Banking crises occur when a large fraction of the banking industry is unable to meet deposit outflows or has become insolvent when valued at current asset prices. Individual banks face risks of bankruptcy arising from idiosyncratic factors related to bad investments, from runs by depositors, or from general adverse movements in asset prices. Each of these three originating sources of bank failures can, potentially, lead to a banking crisis, and each can imply different roles for policy authorities.

Sources of Bank Failures

Because banks hold risky assets, they face a positive probability of failure. This is particularly true if banks have specialized expertise in overcoming problems of adverse selection and moral hazard in making loans, since by their very nature, these problems only arise in the presence of risk. Adverse selection is a particular problem in credit markets; potential borrowers are likely to have much better information about their investment plans and the likelihood of their success than do outside observers. Not only does this mean that bad credit risks cannot always be identified, but it also means that bad risks may have a greater incentive to borrow than do good risks.

As a consequence, the price of credit may be unable to equilibrate demand and supply in domestic credit markets. In the face of an excess demand for credit, a higher interest rate does not necessarily make additional lending profitable, since the pool of potential borrowers will change as interest rates rise. Higher rates may simply attract a riskier pool of borrowers—the

adverse selection problem—and actually lower the lenders' expected return. In addition, higher interest rates may induce borrowers to undertake riskier activities—the moral hazard problem. Thus, any lender will need to engage in monitoring activities, and the cost of such monitoring may make lending unprofitable.⁷

Because of the risk inherent in lending activities, then, individual banks will, on occasion, fail. However, the risks of banking failures that result from idiosyncratic factors leading to insolvency for an single bank are generally not important from a public policy perspective. Individual banking failures are more likely to occur if the banking sector is characterized by a large number of small banks with relatively nondiversified portfolios. However, this situation is also one in which the failure of an individual bank is, of and by itself, of only minor consequence for the economy as a whole. If there is implicit or explicit deposit insurance designed to reduce the threat of contagion, the potential for moral hazard problems to arise will imply that policy makers will want to reduce the fragility of individual banks.

Contagion

Individual bank failures can pose a serious problem if they generate deposit runs on healthy banks and lead to a banking panic. This possibility arises because, in the absence of deposit insurance, depositors, as lenders to banks, also face problems of asymmetric information that are similar to those faced by banks in their lending activities. If depositors are unable to easily monitor the value of a bank's portfolio, then the failure of a single bank can alter depositors' expectations about the solvency of other banks, leading to deposit runs that threaten all banks.

Runs adversely affect the real economy in three ways. First, depositor wealth is reduced as a result of liquidation costs associated with selling bank assets to meet withdrawals. Second, by shrinking the banking sector, investment activities heavily dependent on bank financing are reduced. Although the same volume of credit could flow through fewer institutions, bank failure can sharply reduce the extent of information on borrowers not sufficiently credit worthy to fund themselves directly, and so lead to lower economic activity (Bernanke, 1983). This effect, while less likely to be significant in more developed markets, more regularly

characterizes developing countries, in particular outside major cities. Third, by shrinking bank liabilities which are part of the payments system, runs reduce the supply of money.

Contagion effects arise when the failure of an individual bank or a small number of banks leads to runs that threaten the ability of the banking sector to meet depositor withdrawals. This situation can arise even though the banking sector as a whole is solvent. Thus, financial panics can originate with the bankruptcy of a small number of banks if depositors then fear an inability to withdraw funds from a wider group of banks, thereby generating a widespread financial panic.

By providing access to an elastic supply of bank reserves, the LOLR can ensure that solvent banks facing deposit withdrawals are able to meet the demands of their depositors. In addition, the existence of a LOLR can lower the incentive deposit holders at solvent banks have to withdraw their funds; if they are confident the LOLR will provide short-term liquidity, attempts to withdraw funds become unnecessary.

This discussion suggests that deposit insurance serves some of the same functions as a LOLR in limiting banking crises. Specifically, deposit insurance is a substitute for the LOLR's commitment to allow depositors to access their funds. As will be discussed below, however, the same issues of asymmetric information that can give rise to panics also can imply that measures such as deposit insurance or a LOLR create moral hazard problems that may make bank failures more common.

Fundamentals and expectations

While general discussions of banking crises tend to associate contagion effects with depositor initiated runs, the academic literature has, like the more general literature on asset pricing, distinguished between financial panics based on fundamentals and panics basic on exogenous factors akin to “sunspot” equilibria. This later view sees panics as triggered by random and ultimately unpredictable events (“shifts in the beliefs of agents which are unrelated to the real economy” Gorton 1988, p. 751) and depend on the sequential service characteristic of banks—those first in may get full redemption at par, while later those last in line may receive substantially less.⁸ The former view has stressed the role of information-based panics, that is, panics initially generated by the rational response of depositors to changes in information

about the value of bank assets. The initial cause of a panic, then, is related to movements in economic fundamentals affecting the value of banking sector assets, such as interest rate increases, general asset price declines, changes in economic policies that cause investors to re-evaluate the potential earnings of banks' claims on firms, or sharp decreases in inflation that raise ex-post real rates.⁹

Gorton (1988) argues that the empirical evidence from the U.S. supports the view that information based panics related to "fundamentals" provide a better description of actual historical episodes of financial crisis. This implies that it is important to focus on the familiar risks to fractional reserve banking systems, including bad luck in the form of changes in international relative prices that reduce the market valuation of domestic firms and in turn the commercial banks' claims on firms, or economic policies that cause investors to reevaluate the potential earnings from the domestic capital stock. A failure of market oriented reforms or excessive accumulation of government debt are further examples of changes that could threaten the asset base of the domestic financial sector. Caprio and Klingebiel (1996) find that macro factors are potentially important: in a sample of over 80 crises in about 70 countries, in 75% of the cases there was a real terms of trade decline of over 10% in the years leading up to the crisis, with the average drop of 21%. However, they also note that in 100% of the cases, poor incentive systems -- those that did not encourage bankers to take only prudent risks -- were found. While panics based on fundamental (micro or macro) factors would seem then to be of greatest relevance empirically, open economies may also be subject to crises that have the character of exogenous shifts in beliefs. The effects of the Mexican economy on Argentina provide one such example.

Real Consequences of Panics

The consequences of banking panics will depend on the role played by banks. If the Modigliani-Miller Theorem characterized the financial system, variations in the size of the banking system would have no consequences for real economic activity. Bank borrowers would simply turn to alternative, nonbank sources of funding, while substitutes for bank liabilities would be used in undertaking transactions. There would be no compelling argument for a LOLR or other policies designed to support the banking sector. However,

contrary to this view, the banking sector is normally considered to play an unique and especially pivotal role in the financial system.¹⁰

Chinn and Dooley (1995) provide empirical support for the idea that bank credit is an important determinant of investment and economic growth in countries with repressed financial systems. Their interpretation of data for a sample of Asian developing countries is that bank deposit markets are highly integrated with international capital markets but bank loan markets are somewhat isolated. Since domestic firms cannot bypass the domestic bank loan market, either by utilizing alternative domestic financial markets or international markets, changes in the supply of bank credit are important determinants of domestic spending decisions after controlling for the effects of changes in the supply of domestic money.

Insurable risks

When the possibility of contagion can arise from the failure of a few banks as a result of idiosyncratic factors, the lender of last resort function could be performed by a government agency or a private institution. In this situation, however, the primary objective is to prevent a banking failure from generating runs on solvent banks. Thus, the ability to reduce or eliminate the incentive for runs is more important than the need to have mechanisms for increasing banking sector reserves to stem a run in progress. Deposit insurance may also provide adequate protection against contagion effects in this case, eliminating the need for a LOLR.

The traditional view did see the lender of last resort function as providing a form of insurance. That is also why private institutions can, in principle, serve to insure healthy banks against the risks of individual banking failures. When runs are initiated by depositors, the problem is not “asset values” in some longer-term sense but the ability of banks to liquidate at prices at which they are still solvent: the main issue is determining which institutions are actually solvent in this longer-term sense and in ensuring that moral hazard problems (the problems attendant with the investment by banks of riskless deposits in risky assets) are limited.

It is the need to determine bank solvency so that the LOLR does not lend to insolvent banks that has justified much of the regulatory structure that generally characterizes the banking industry. When bank assets are difficult to value, a private insurer, or an external agency that has no regulatory authority, may have difficulty distinguishing solvent from insolvent banks. In addition, the provision of insurance, either in the form of explicit deposit insurance or access to a lender of last resort, will generate incentives for banks to adopt riskier investment strategies since the insurance essentially subsidizes their risk taking activities. Here again, some regulatory oversight can serve to limit this moral hazard problem. To the extent that such oversight is needed, however, the ability of a private insurer or an external agency to substitute for the involvement of the domestic government may be limited.

Uninsurable risks

The situation is quite different when it is not the “misguided” attempts by depositors at solvent institutions to withdraw funds that lies at the heart of the potential crisis; rather it may actually be the case that the banking sector as a whole, or at least a significant portion of it, is insolvent. General declines in asset prices will affect the entire banking sector, leading to systematic declines in bank net worth. These declines can be caused by movements in interest rate levels or the exchange rate. With liabilities whose nominal price is fixed, asset price declines threaten the solvency of the entire banking sector.

However, if banks are to provide a source of credit that is able to deal with adverse selection issues, while still issuing liabilities fixed in nominal value, risks will be inherent in banking. So the issue becomes one of who bears the risk. In modern banking and financial systems that someone is, to a large extent, the government (and so, ultimately, domestic taxpayers). The government is the only agency that can do so because the risk of a general decline in the market valuation of the capital stock is not an “insurable risk”. That is, we cannot insure the value of banks’ liabilities on the basis of a calculation that some banks will fail but on average the aggregate value of banks assets will be predictable. General declines in the value of banks’ assets are common and, if depositors are to be protected, require the government to redistribute income, generally from tax payers to deposit holders, when the market value of banks’ assets decline. To be sure, governments may not want to protect depositors, as a

result of moral hazard problems, but with large enough systemic shocks, most governments will step in to at least lighten the burden on depositors.

A small open economy with a fixed exchange rate is obliged to allow changes in international interest rates to affect the asset values of the entire banking sector, so that any lender of last resort role is likely to involve lending to (temporarily) insolvent banks. If adverse selection problems intensify during periods of high interest rates, as argued by Mishkin (1994), domestic credit allocation and the level of economic activity will be adversely affected.

From the perspective of an open economy, the risk faced by the domestic banking system may in part arise from the behavior of other countries. The impact of the Mexican crisis on Argentina is an example—this can be viewed as a form of externality, similar to the externality faced by an individual bank whose risk of a run can depend on the investment behavior of other banks—the source of contagion effects. Just as this latter externality creates a demand for insurance that could be provided by a private institution or a government agency, the former risk faced by an open economy generates a role for insurance. However, this cannot be provided by a domestic private agency since diversification arguments would require the insurer to provide insurance across many individual economies. As argued above, a private LOLR can deal with the case of contagion effects generated by the failure of a small number of banks which then threatened those banks that are still solvent. However, this traditional view of the role played by a LOLR, as a consequence, may be of little relevance to the situation in which the risk is of a systematic asset decline that affects the asset value and solvency of the entire banking sector.

IV. The Role of Reserve Requirements in Strengthening a LOLR¹¹

100 % reserve banking

When banking panics affect the real economy through their impact on the payments system and the stock of money, an apparently easy fix is to require that commercial banks insure the convertibility of their own deposits into foreign exchange or domestic reserve assets (since the currency board is committed to making domestic reserves and foreign exchange perfect substitutes). Clearly, if banks were required to hold US Treasury bills equal to one hundred percent of their deposit liabilities there would be no additional problem for the currency board. In this way, individual banks, by in effect becoming money market funds, are completely able to meet any deposit withdrawal at any time and contagion effects are removed.

In the absence of a LOLR, the question arises as to whether banks could remain credible under all circumstances while still holding less than 100% reserves against their deposits. Evidence that they could not do so is convincingly provided by money market mutual funds in the United States. In these institutions there is no foreign exchange risk, but the market demands a very conservative investment portfolio of short term government securities or insured bank deposits in order to insure convertibility.

While complete reserve backing makes sense as a means of protecting the money stock and the payments mechanism from banking panics due to contagion effects, it may not make sense if it is bank lending that is important for economic activity. If banks are forced to hold reserve assets equal to their deposit liabilities, then the obvious problem is that all domestic maturity transformation is forced into nonbank institutions. This has two flaws.

First, if nonbank institutions offer monetary deposits to the private sector we have simply moved the problem to what are usually less regulated institutions. In many cases such institutions have been owned by banks and typically have borrowed from banks in the event of a withdrawal of deposits. There do not seem to be any modern examples of a banking system that has been prevented from engaging in the profitable business of maturity transformation.

Second, adverse selection and moral hazard problems are particularly important in credit markets. This means that forcing domestic maturity transformation into nonbank institutions is inefficient to the extent that banks have particular advantages in overcoming the informational problems associated with credit issuance. By developing long-term customer relationships, using lines of credit and maintaining transaction account balances, banks are better placed to provide monitoring services than are nonbank intermediaries.

In addition, forcing maturity transformation into the nonbanking sector requires that nonbank institutions raise nondeposit external funds in order to lend for investment activity. But this ignores the problems introduced by asymmetric information that are an important aspect of banking. As Stein (1995) has emphasized, adverse selection problems hamper the ability of financial institutions to obtain funds. That is, some of the same problems that distinguish the market for bank lending occur also in the markets in which banks, or other nonbank institutions, raise funds (see Annex 1). The general conclusion that deposit and nondeposit funding sources are not perfect substitutes in the presence of asymmetric information is a robust one. Consequently, deposit outflows will reduce the ability of banks to lend; real investment and real economic activity will be affected. To the extent that lending is forced into the nonbank sector, the financing of investment activity is made more dependent on external, nondeposit funding and, consequently, to more serious adverse selection problems.

The fundamental problem is that the community wishes to transform some current output into a capital stock; the capital stock is itself illiquid. If any claims that ultimately derive their value from the capital stock have fixed nominal values, there is a risk that someone must bear. This has the implication, though, that a second possible solution to banking sector instability in the absence of a lender of last resort would involve moving away from fixed nominal value liabilities.

With less than 100% reserves, the comparative advantage of banks in the credit process is utilized but the need for a LOLR again emerges. Open market operations as a measure of providing an elastic supply of reserves can serve as an alternative to such a lender. However, this just shifts the issue of how reserves are created, or who holds a sufficient inventory of reserve assets from the currency board to the agency empowered to conduct open market operations.

In summary, while private insurance or publicly backed deposit insurance can effectively serve to eliminate contagion effects arising from the failure of a few banks, they cannot serve to support the financial system in the face of general asset declines that affect the solvency of the entire banking industry. Since banking sector contractions triggered by a crisis will have adverse effects on economic activity through either credit or money supply channels, some mechanism is required that can provide an elastic supply of reserve assets if necessary. Such mechanisms need to address two situations. First, a credible commitment to ensure the value of bank deposits can eliminate the incentive for depositors to make withdrawal during an incipient crisis. By eliminating, or reducing the risk of contagion effects, the major impact of financial crises can be avoided. Second, by providing an elastic supply of reservable assets, actual deposit runs can be contained without the need for banks to close their doors.

Are high reserves an option?

If 100% reserves cannot serve to support the financial system, are high reserves an option?

In this section we analyze a policy designed to limit risk by requiring banks to engage in maturity transformation but nevertheless to hold liquid reserves that are high relative to what the banks would choose to hold. These reserves might be interest bearing or not. Moreover they need not be held at the central bank but could be held in any liquid form. The issue is whether or not such reserves serve as a “cushion” to absorb changes in the private sector’s preferences for bank deposits and other assets. If one hundred percent reserve requirements might stabilize the system, a natural question is whether or not “high” reserve requirements might also stabilize the system but with lower costs in terms of disintermediation.

Banking markets in developing countries have been characterized by relatively high reserve requirements. Financial markets in such economies are typically dominated by commercial banks and financial repression is an important source of revenue in many cases. As shown in Drazen (1989) the key to this revenue is the imposition of reserve requirements on all bank liabilities. This would normally encourage the growth of nonbank financial intermediation, so a natural extension of this policy is to discourage development of domestic nonbank financial intermediaries and to impose capital controls that discourage nonbank borrowing in foreign markets.

Another form of disintermediation would be for domestic firms to seek credit in foreign markets. But in most emerging markets, domestic nonfinancial firms cannot bypass domestic banks because it is difficult for the firm to offer foreign lenders credible information about their financial condition. Asymmetric information is a well known problem that limits lenders' ability to distinguish between good and bad credit risks. In developing countries, disclosure of financial information is not mandated by law as a condition for access to equity or bond markets, traded equity is limited to a few of the largest firms and accounting standards are less commonly applied. This presumably makes the information generated by a relationship with a domestic bank, that at least has information about the firm's and the firm's owners' transactions, valuable and difficult to replicate.

A model of a partially open financial system:

These institutional constraints suggest that we can better understand the possible effects of high reserve requirements in a model in which domestic bank loans are "special" but in which the domestic bank *deposit* market is highly integrated with international financial markets. In this section we utilize an open economy version of a model developed by Bernanke and Blinder (1988). The primary conclusion suggested by the model is that high reserve requirements magnify the size of private capital inflows when expected yields favor developing countries but also magnify the size of private capital outflows when expectations change. It seems to follow that a large stock of liquid reserves held by the banks does not really offer protection from changes in the market's valuation of bank loans relative to foreign assets. The important lesson is that as the reserve requirement rises, the size of the private capital inflow and the change in the central bank's reserve also increases. Moreover the response is symmetrical for inflows and outflows.

To focus on these implications, consider a simplified model of the financial sector under a fixed exchange rate. Banks hold reserves, loans and government securities. Bank liabilities are domestic demand deposits ('money') and nonmonetary deposits. Both are assumed to be subject to a legal reserve requirements of t . To capture the special nature of bank lending, we assume that domestic firms can issue only bank loans. The absence of both a nonbank bond market and a market for firm equity reflect asymmetric information and regulatory constraints. Deposits, foreign bonds and domestic government bonds are perfect substitutes;

the return on deposits will be r . The central bank issues reserves; its assets are domestic government securities and foreign reserve assets.

The formal model is developed more fully in Annex 2, but the basic implication is that the stock of reserves will be determined by the loan market equilibrium condition. Intuitively, profit maximizing banks will set the loan rate equal to $r/(1-t)$, their marginal cost of funds. Thus, the equilibrium quantity of loans is determined by loan demand at a loan rate of $r/(1-t)$. With the demand for monetary assets also a function of r , for given income levels, the banking sector's nonmonetary deposits must adjust to fund the quantity of loans demanded. With monetary and nonmonetary deposits now determined, the demand for bank reserves is simply $t(M+D)$.

A fall in world interest rates lowers the domestic loan rate and increases the quantity of loans. Banking sector deposits must rise and this determines the change in the quantity of banks' nonmonetary liabilities; this in turn also changes the demand for reserves depending on the reserve requirement against nonmonetary liabilities. If the central bank was entirely passive, the increase in the demand for bank reserves would be met by an increase in supply generated by unsterilized intervention in the form of purchases of international reserve assets by the central bank.

A shift in money demand does not increase the demand for reserves since the shift from interest bearing deposits to monetary deposits, which carry the same reserve requirements, leaves the net demand for reserves unchanged¹². The increased demand for reserves comes from the shifts in the bank loan market. As shown in Annex 2, the impact of a change in the world level of interest rates on reserves depends upon the reserve requirement t and the elasticity of loan demand to the loan rate.

This analysis assumed profit maximization on the part of banks, thereby ensuring a simple relationship between the loan rate and the deposit interest rate. This represents one approach to answering the difficult question of how the spread between the deposit rate and the loan rate should be modeled. Romer and Romer (1993), for example, assume that the spread decreases as r declines. This makes sense because the implicit tax imposed by a noninterest bearing reserve is increasing in r , that is, the tax per dollar of loan is $r/(1-t)$. Thus, higher

nominal interest rates imply a larger absolute spread and falling interest rates would be associated with a fall in the spread. It follows that the higher the reserve requirement the greater is the change in the loan rate in response to a change in the world interest rate. This means that high reserve requirements do not help insulate the domestic economy from the transmission of shocks from international capital markets.

So far we have focused on the effects of a given reserve regime as world interest rates change. But what is the effect of a change in the differential reserve? Suppose for example that a fall in the world interest rate and the resulting capital inflow induces the government to raise the reserve requirement. A rise in the reserve requirement increases the loan rate relative to the world rates, so the impact effect on the demand for loans is negative. The impact effect on reserves and private capital flows can also be shown to be negative.

Thus, the immediate effect is to reduce the capital inflow and the gain in reserves. But other things equal, the rise in reserve requirements clearly increases the cost of bank loans. In effect the domestic borrower must pay the tax on the marginal foreign money. This has the effect of discouraging the transmission of the real effects of the interest rate change. So evidently a constant high reserve requirement has perverse effects. But an endogenous reserve requirement policy that increases reserve ratios as world rates fall succeeds in insulating the domestic loan market from the external shock. The “sterilization” policy succeeds not because it discourages international capital mobility but because it discourages domestic financial intermediation.

In summary, high reserve requirements seem to be perverse in that a high level for reserves on nonresident deposits increases the sensitivity of private capital flows and domestic credit to a monetary disturbance. A high level of the reserve requirement also magnifies the change in international reserves generated by a foreign monetary shock. Although a high level of reserve requirements on bank deposits seems to be counterproductive, the model also implies that changes in the level of reserve requirements can fully insulate the domestic economy from the foreign monetary policy shock. It is important to remember, however, that in this framework the banking system is being “stabilized” by changes in the taxation of domestic financial intermediation, large variations in which can be expected to lead to a permanently smaller banking system.

The main problem for the LOLR is the adverse effect changes in interest rates have on banks' asset values. It is true that with high reserve ratios the average decline in banks' asset values will be much lower, and that most of the capital outflow will be easily covered by liquidation of banks' reserves. But it is also true that the capital outflow itself is larger. As with low reserve requirements, the financial system is brought into equilibrium by changes in the domestic loan rate. But with high reserve requirements, these changes in domestic loan rates are magnified. The greater volatility of the domestic loan rate tends to increase the risk of insolvency of domestic firms and in turn increases the risks faced by the LOLR. This in part was the very real problem faced by the Argentine authorities in the post-tequila shock and the resulting banking crisis of early 1995. Asset values plummeted, deposit withdrawals ensued, interest rates rose to distress levels, and the system's limited LOLR capacity was severely tested.

V. Currency Boards and the Credibility of the Exchange Rate Peg

The discussion to this point has, in general, considered the role of a LOLR that serves to insure the domestic currency value of the bank sector's liabilities. However, another factor that can magnify the effects of international interest rate changes are expectations that the exchange rate peg might be changed. The currency board faces this additional risk because it is insuring the foreign currency value of some set of domestic deposit liabilities. As long as the exchange rate commitment is not perfectly credible, the existence of domestic currency and foreign currency assets and liabilities on banks' balance sheets is an important source of solvency risk even if the currency positions are balanced.

The problem is that one of banks' main functions in the system is to bear maturity risk. During a time period in which the board's commitment to the fixed exchange rate is not fully credible, any shock that increases the political cost of maintaining the fixed exchange rate increases the exchange risk premium component of domestic currency interest rates. The rise in interest yields paid on domestic currency denominated assets depresses the market value of

banks' long term domestic currency assets. This reduction in the market value of long term assets is not matched by a reduction in the value of banks' short term domestic currency liabilities. Thus even a balanced foreign exchange position leaves the banks exposed to changes in exchange rate expectations.

If all bank assets and liabilities were denominated in foreign currency, this risk would be eliminated, although changes in dollar interest rates would still generate capital gains and losses on banks' assets. Experience suggests that changes in dollar interest rates have been quite small relative to changes in domestic currency interest rates in Argentina and other developing countries that have fixed their exchange rates. It seems to follow that complete dollarization would contribute to the stability of the banking system.

As discussed in some detail above, a lender of last resort must respond before it is possible to distinguish transitory from permanent shocks to asset values. In a similar way, it is very difficult to identify changes in asset values generated by shifts in the credibility of the exchange rate commitment. Even after the fact, the inability to measure exchange rate expectations makes it difficult to disentangle the forces behind changes in yields on domestic currency and foreign currency assets. Frankel and Okongwu (1996) analyze the determinants of domestic interest rates in five developing countries from 1987-1994 (Argentina, Chile, Mexico, Philippines and Korea) and conclude that survey data on expectations about exchange rate changes suggest that high domestic interest rates reflect both expected exchange rate changes and a surprisingly large exchange risk premium.

The threat of contagion in the context of limited information seems identical for any of the risks discussed above. In the very short run, depositors will not be able to distinguish banks that can survive a change in domestic interest rates from those that will not be able to do so, particularly in cases where important bank customers also suffer from the rise in short term interest rates. This implies that a currency board with a mixed currency banking system is not only unstable for the fundamental reason set out in section II but also because it is likely to be subject to unusual changes in asset valuation. Such a system will require a generous backstop.

Complete dollarization of banks' assets and liabilities eliminates conversion risk. As argued above, sharp increases in domestic currency interest rates when convertibility is called into question may, in practice, be the most serious threat to banks' solvency. As long as the national currency exists, it is very unlikely that market forces alone will generate a completely dollarized system. Some types of transactions are likely to continue to be made with the national currency as long as it exists, and any difference of opinion about the credibility of the exchange rate commitment will make private contracts denominated in the home currency attractive to some market participants. Complete dollarization of the domestic banking system would have to be enforced by law. Banks might be licensed to operate only in dollars or domestic currency denominated assets and liabilities might be taxed.

The current currency mix of the Argentine banking system is an important source of instability. The rapid increase in the share of dollar denominated deposits in Argentine banks following the introduction of the convertibility plan might be interpreted as the result of the private sectors lack of confidence in the exchange rate regime. But an equally plausible explanation is that an increase in confidence in the domestic banking system induced residents to move dollar denominated assets from off shore to domestic banks. The switch to dollar denominated from peso denominated assets during the earlier period of high inflation is likely to be persistent (Guidotti and Rodriguez, 1992), but the location of such assets will be quite sensitive to current economic conditions. During 1994 and early 1995, non-peso deposits in Argentine commercial banks exceeded pesos deposits, reaching as much as 57% of all deposits at the end of March 1995. Returns on both types of deposits respond to changes in international interest rates. But the presence of both pesos and non-peso deposits leaves the banking system subject to conversion risk, and, as argued above, sharp increases in domestic currency interest rates when convertibility is called into question may, in practice, be the most serious threat to banks' solvency. Conversion risk arising from expectations of exchange rate changes would be eliminated under a complete dollarization of banking sector assets and liabilities.

While partial dollarization of the banking system has been an important feature of several stabilization programs (Savastano, 1995), it does not follow that the problem associated with

a mixed system will solve itself by the private sector moving toward complete dollarization. A reasonable interpretation of recent increases in the share of dollar denominated liabilities of Argentine banks is that residents have repatriated dollar assets held offshore as conditions have stabilized at home. This process however is clearly limited. As long as some probability of exchange rate changes remains, peso denominated assets and liabilities offer protection to some set of market participants. It follows that the government would have to tax these positions in order to reduce the threat of capital losses for the banks.

This does not mean that the domestic currency money issued by the Board would have to be dollarized. Fischer (1982) identified the seigniorage tax the domestic economy would need to pay to the U.S. to accumulate a growing stock of dollars as income, and with it, money demand, grows as a cost of dollarization. But the Currency Board could continue to issue fully backed domestic currency and could continue to collect the seigniorage associated with this issue of noninterest bearing money. In fact in a more stable environment the demand for the Board's monetary liabilities would increase and in turn increase seigniorage. Thus, the authorities could argue that their desire to limit private banks use of their currency "brand name" is evidence of their commitment to the convertibility law.

Dollarization does not, however, eliminate traditional credit risk nor does it eliminate risk associated with movements in dollar interest rates (although, as noted above, these have tended to be small relative to domestic rates). Once the banking system is on a dollar basis, the government cannot act as a lender of last resort unless it, in turn, has access to dollar credits. In the Argentine case, the BCRA's ability to substitute 20% (and up to 33% in a crisis) of its reserve backing with domestic dollar denominated issues would mean that it would lose some of its limited LOLR capacity in a fully dollarized system. The credibility of the government's commitment to refrain from devaluation in order to stop a run on the banks is of course now assured since devaluation of its own liabilities would not affect the value of banks' assets or liabilities.

If this is what the authorities want to achieve, that is, a completely credible commitment not to debase the currency, then complete dollarization seems to be a stable regime in the sense that it obviates the risk that a shift in the private sectors expectations about devaluation could bring the system down.¹³ It appears, however, that such a system would continue to face the

'garden variety' risks faced by any fractional reserve banking system. Nevertheless, dollarization of the banking system might be a useful policy since a LOLR would only have to deal with familiar solvency problems.

VI. Examining Alternative LOLR Options

Policy Overview.

The basic choice facing the authorities is to continue with a limited public LOLR function, recognizing its shortcomings, or to move to a pure currency board arrangement. That decision appears to have been made and one may argue that given the state of the financial market development in Argentina today a full abrogation of the LOLR function may not be feasible. Likewise, no credible alternative to convertibility has been proposed which would serve to maintain the confidence of the Argentine public, although at least in theory some form of constitutionally mandated "fiscal rule" is plausible. That being said, the outlook in the immediate future is likely to be a continuation of a quasi-currency board system with some LOLR capacity and a continuation of the central tenet of Argentine policy since 1991, full convertibility on demand.

Experience clearly shows that no external official LOLR exists. Existing credit facilities at the IMF, although in theory designed to support exchange rate decisions of the Argentine type from reversible, externally-induced shocks unrelated to macroeconomic fundamentals, appear to be too slow to provide any immediate additional backing to reserves. Thus, the BCRA remains boxed in by the limited amount of excess reserves that it holds at any point in time. The multilateral development banks, like the World Bank, are committed to financial sector development but are unlikely to put themselves in an active LOLR role which would require them to rely on domestic supervision efforts to provide lines of credit on demand. The issue of what is a liquidity problem and what is a solvency problem is not something that international lenders are likely to feel comfortable judging in the midst of any crisis, the main problem being that from time to time the international lender would have to make real transfers in exchange for future claims.

What has not been tried to a significant degree, the case of US assistance to Mexico being the clear exception, are official bilateral lines or asset puts. The US Treasury has limited its interventions to Mexico and the Federal Reserve System has shown no interest in performing that role. Some surplus economies, like Taiwan (China) or Norway, might not be adverse to buying official (presumably high yield) debt, but to do so in a crisis places the purchaser in the risky position of having to judge whether the crisis is one of confidence alone, either externally or internally induced, or whether it has a more fundamental character. In any event, it seems inescapable that the international lender would have to become deeply familiar with the supervision and prudential regulation of the banking system, and be able to step in and force the closing of individual banks. Unless government were willing to "farm that function out," as for example some Asian countries have done for their customs service, clearly an unlikely prospect, no official lender is likely to step into the LOLR arena.

It has been argued that a domestic LOLR is not necessary if the currency board allows foreign banks to enter the domestic market and allows domestic banks easy access to international capital markets. Hanke and Schuler (1993) argue that "By eliminating exchange risk with the reserve currency, the currency board will facilitate access of the commercial banks in the currency board country to foreign financial markets. The currency board system will also encourage foreign commercial banks to establish branches, in effect importing access to foreign financial markets."

There are two problems with this argument. The first is the argument that domestic banks enjoy an advantage in evaluating credit risks in emerging markets.¹⁴ Given little reliable information of domestic firms, banks in emerging markets with established customer relationships enjoy a large competitive advantage. In the case of Argentina, easy entry into domestic markets has not generated a large increase in foreign bank participation. Schwartz (1993) argues that the prevalence of branch banking in currency boards within the British Empire was not a response to currency boards but to the colonial status of the countries, and the associated reduction in political risk.

The second question is what would happen in response to a general decline in domestic asset values. International banks might allow their branches or affiliates to fail if the local government did nothing to support them in a panic situation. In fact, without some formal

agreement, industrial country central banks would probably encourage such prudent behavior. Foreign central banks have the capacity to insure their banks' foreign branches but the incentive to do so is weak. Of course, this would certainly come at the expense of the foreign commercial bank's reputation and ability to do business in the country in the future. Hence, the more attractive the long term local investment climate, the less likely is this reaction. Strategic alliances with foreign banks are a more likely possibility.¹⁵

Public Sector Actions to Strengthen the Reserve Position

A necessary condition for the long-term survivability of the system is that the Central Bank have sufficient free reserves to offset a 'bad draw' for the foreign currency value of bank assets. Since claims on the private sector in the Argentine system are about \$50 billion, an adequate reserve is perhaps 20% or about \$10 billion. Reserves could be increased through sales of long term government bonds to central banks in a strong surplus position. Relatively high-yielding dollar bonds of the nation could be offered to central banks in East Asia, for example, with the proceeds invested in short-term US dollar issues, the differential being part of the price of extra insurance. A second option might be to allow the central bank to retain its profits, which could add another \$ 2.5 billion in total reserves by the year 2000. In addition, thought could be given to separating and eventually disposing of the Banco de la Nacion, the largest bank in the country and one still in the public sector. Care would have to be taken in privatizing it, so as not to allow the creation of any private bank too large to fail, but forcing BNA into the rigor of the market-place has advantages even beyond its sale price. It would also have the effect of reducing potential public liability associated with any reduction in future asset values.

At the same time, one may argue that the LOLR rules should be made more stringent, not weaker as some have argued, by: (i) enforcing prudential regulations and supervision very strictly to match the "super capital-adequacy ratio" of 11.5%; (ii) using the powers available to the BCRA through article 35 bis¹⁶ in non-crisis times to remove weak banks, say those rated 4 and 5, from the system entirely; and (iii) allowing further consolidation of the banking sector if and only if the resulting bank is as strong after the merger or acquisition as

- before, and fully meeting all prudential requirements.

The second aim of policy might be to reinforce the already apparent tendency of private banks to watch out for themselves in trying to avert liquidity crises and the need to rely on the official LOLR capacity. The best way to manage in a system of limited LOLR capability is clearly to rely on it as little as possible, and on the other hand, to make it as expensive to use as possible. In the case of the former, the recent shift to a liquidity policy in place of reserve requirements is a major advance, and with respect to the latter, reforms which do not allow banks receiving extraordinary liquidity assistance (originally offered for 30-60 days) a total of up to 3 years to repay would be appropriate. This requires the repeal of BCRA Communication A-2368 which extends the life of weak banks.

Another area of potential strengthening is in supervision rules, although large strides have been made in recent years. Mandatory intervention rules when risk-adjusted capital falls below some pre-determined level is one possibility. Some have suggested penalties for central banks which offer forbearance to provide immediate disincentives. The key is to force bank owners to act before the situation becomes critical by putting their equity at greater risk sooner, and thus trying to force earlier mergers and acquisitions at the first sign of danger. Increased disclosure requirements and significant penalties for nondisclosure or erroneous information, which make it easier for outsiders to monitor banks, also will lessen the burden on the LOLR function. Still, these moves to lessen the likelihood of having to use LOLR interventions, however, are no substitute for increased reserves.

Summary

It may well be the case that within the existing rules of the game, in which the BCRA is charged with both providing some LOLR functions as well as full convertibility of the peso-- basically two objectives with one instrument, namely reserves -- the balance of responsibilities needs to shift. Complete dollarization can significantly reduce the risks but not entirely eliminate them. If the BCRA can concentrate more on building up reserves and helping to ward off crises of currency confidence, perhaps the banking system can provide itself with greater protection from liquidity shocks. This will require, inter alia, that consolidation of the sector, which has the potential of gaining greater access to outside

liquidity, and prudential strengthening of the system. The process of triage of weaker banks should continue and not await another crisis. Greater experience with the new liquidity policy is also required, and reforms are needed in the way the settlements system works as this affects the functioning of the inter-bank market, which is essential for containing crises.¹⁷ In sum, however, no grand solution appears to exist for what is inherently an inevitable problem of a mixed central bank-currency board system. The strategy therefore turns on actively strengthening the banking systems to reduce solvency risks.

Annex 1

Stein (1995) considers a simple model in which banks can use insured deposits or uninsured external financing to fund new loans. Adverse selection arises because Stein assumes banks have private and unverifiable information on the value of their existing loan portfolio. If there are two types of banks, those with “good” loan portfolios, and those with “bad” portfolios, a separating equilibria exists in which good banks rely less on uninsured external finance. The bank with the bad portfolio of existing assets has an incentive to borrow more external finance since, if it goes bankrupt it does not need to repay. In order to distinguish themselves from the bad banks in a separating equilibrium, good banks rely less on nondeposit funding sources and more on insured deposits. As a result, an exogenous outflow of deposits forces good banks to reduce their own lending; simply replacing deposit liabilities with nondeposit ones (as suggested would occur by Romer and Romer 1993) would raise the banks’ cost of funds by signaling to the market that the bank’s loan portfolio is bad.

In the face of deposit outflows from the banking sector, real activity will be unaffected only if borrowers have alternative sources of funding that are very close substitutes for bank loans, or if banks have access to alternative funding sources themselves, CD’s, etc., that can serve as close substitutes for deposit funds. Stein’s argument is that this latter possibility is unlikely. The role of adverse selection problems in amplifying the effects of deposit runs on real economics activity, can be illustrated using a model based on Myers and Majluf (1984).¹⁸ This simple example can serve to illustrate the effect of deposit outflows on the banking sector’s ability to finance real investments. The example is developed more fully by Stein (1995); see also Gibbon (1992).

Suppose a bank has existing assets (loans), V , whose value can be either G (high) or B (low); $G > B$. The ex-ante probability that $V = B$ is p . The bank also can make new loans in amount L which offer a gross rate of return of $R > r$ where r is the alternative safe rate of return; hence, the new loans are worth undertaking. The bank’s flow balance sheet is $L = (1 - q)D + E$, where q is the reserve requirement ratio, D is the flow of new insured deposits, while E represents non-deposit sources of funds which we can view as equity. In order to assess the impact of a deposit outflow on the ability of the bank to substitute noninsured external funding in order to maintain its lending, D will be treated as exogenous.

Asymmetric information is introduced by assuming the bank knows whether V is worth G or B . This information, though, is publicly unverifiable. We further assume that $L > (1 - q)D$, so that all banks need to raise nondeposit funds in order to fully fund all new profitable loans. Investors will invest in the bank if and only if

$$s\{[pB + (1 - p)G] + RL - (1 - q)D\} \geq rE,$$

where s is the share of bank value promised to the investor. This condition simply requires that the expected gross return to the investor exceed r . For the bank, though, raising external funds can be shown to be worthwhile only if

$$s \leq RE/[V + RE + (R - 1)(1 - q)D]$$

This condition is less likely to be met by banks for whom $V = G$. That is, raising external funds will be more likely to be profitable for banks with low value assets. Thus, good banks will have an incentive to separate themselves from bad banks by raising fewer external funds. In fact, in a separating equilibrium, bad banks offer a share $s = RE/[B + RE + (R - 1)(1 - q)D]$ while good banks offer an $s < RE/[G + RE + (R - 1)(1 - q)D]$. As a result, not all potential borrowers from good banks will be funded and investment will be inefficiently low.

Annex 2

Consider a monetary sector in isolation in that real and nominal income is predetermined. The financial system is the simplest possible with a banking system, and the exchange rate is fixed. Banks hold three assets, reserves R , loans L and domestic government securities B . Banks issue two liabilities, domestic demand deposits M , henceforth “money”, and nonmonetary deposits D , henceforth “deposits”, that carry a legal reserve requirement of t . Firms issue bank loans only. They cannot issue bonds to other residents or to nonresidents. The absence of both a nonbank bond market and a market for bank equity reflect asymmetric information and regulatory constraints. The central bank issues reserves for the banks R ; its assets are domestic government securities B and foreign reserve assets R^* . The relevant balance sheet constraints are

$$(1) \quad R = tM + tD$$

$$(2) \quad L + B = (1 - t)M + (1 - t)D$$

We assume that foreign bonds, domestic government bonds and deposits are perfect substitutes for both residents and nonresidents. Given the credibility of the lender of last resort commitment and the fixed exchange rate commitment, this means that the domestic deposit rate is always equal to the foreign interest rate. Residents' demand for money is

$$(3) \quad M_d = M(r, Y)$$

Equation (3) defines a traditional LM curve in (r, Y) space.

Bank profits are equal to $\rho L + rB - rD = [\rho(1-t) - r]D + \rho(1-t)M + (r - \rho)B$, where ρ is the loan rate. Profit maximization requires that $\rho(1-t) - r = 0$ or $\rho = r/(1-t)$. Since this implies that the loan rate exceeds r , $r - \rho < 0$ and $B = 0$.

If firm demand for loans is given by $L(\rho) = L(r/(1-t))$, $L' < 0$, then equilibrium in the loan market requires that $L(r/(1-t)) = (1-t)[M(r, Y) + D]$, or using (1), this can be written as

$$(4) \quad L(r/(1-t)) = (1-t)R/t$$

which determines the equilibrium level of reserves, given the world interest rate.

In the context of this model we can evaluate the effects of high reserve requirements. The shock to the system that seems most relevant is a change in the yield demanded by residents and nonresidents that makes them indifferent between domestic bank deposits and foreign assets. This yield might change because investors fear default on domestic deposits because of capital losses on banks' loan portfolio, expectations that domestic currency deposits might fall in value due to devaluation of the exchange rate or simply a rise in the foreign interest rate. In the text, we also argue that changes in exchange rate expectations might interact with expectations concerning the solvency of the banking system, but for now we focus on the simple case of a change in the foreign interest rate.

Holding income constant, we can solve this system for the change in reserves (and by the balance of payments constraint the private capital inflow) as a function of the change in the foreign interest rate as follows

$$(5) \quad dR/dr^* = -tL' / (1-t)^2$$

where subscripts are partial derivatives.

Equation (5) implies that the change in the demand for bank reserves following a change in the world interest rate depends on the structure of reserve requirements and the elasticity of the loan demand to the loan rate.

The model can be made somewhat more general by allowing the loan rate to differ from $r/(1-t)$. We argued above that the loan rate might react slowly, partially, and perhaps not at all to changes in the deposit rate. In this case, bank loan supply will be increasing in the loan rate p and decreasing in the deposit rate r . Loan demand by firms will be decreasing in p and increasing in the level of income: $L^d(p, y)$. Consequently, there will be a locus of income and loan rate combinations consistent with loan market equilibrium that will depend on the loan supply behavior of banks and the demand for loans by firms.

We now consider the response of the system to a change in foreign interest rates when income is free to adjust. It is clear that the elasticity of the loan market equilibrium locus with respect to the world interest rate holding the loan rate constant is likely to be very low in a repressed system. Given our assumption that domestic deposits and domestic bonds are perfect substitutes for foreign bonds, "the" interest rate that appears in the goods market (IS) relationship can be thought of as the domestic deposit rate. Changes in this rate, other things equal, might affect savings decisions but because of the offsetting income and substitution effects the sign of the effect is ambiguous.

Consider again the conventional M-F framework. In this model the response of the real economy is captured by the slope of the IS curve. As the world interest rate falls domestic investment rises and the demand for money rises because of the increase in nominal GDP. Clearly capital mobility means that the government must increase the monetary base by a fraction of the increase in the demand for money.

Now consider the complete model with the credit market included. The change in international reserves in response to a change in the foreign interest rate is

$$(5) \quad dR/dr^* = [t'(L_p \rho_r + L_y Y_p \rho_r) + (t-t')(Mr + My^* Y_p^* \rho_r^*)] / (1-t')$$

Capital controls in the form of reserve requirements on nonresident deposits have two interesting effects. First, they imply a larger private capital inflow and change in reserves is associated with a given disturbance in the foreign interest rate. Second, they tend to increase, other things equal, the change in the bank lending rate and therefore the real effect of the foreign interest rate change.

Why do countries employ reserve requirements that appear to be counterproductive in that they magnify changes in international reserves? So far we have focused on the effects of a given reserve regime as world interest rates change. But what is the effect of a change in the differential reserve? Suppose for example that a fall in the world interest rate and the resulting capital inflow induces the government to raise the reserve requirement. The impact effect on the demand for loans is

$$(6) \quad dL/dt' = L_p * \rho_r$$

which is negative. Assuming that t remains equal to t' the impact effect on reserves is

$$(7) \quad dR/dt' = (L_p * \rho_r) / (1-t')$$

The immediate effect is to reduce the capital inflow and the gain in reserves. But other things equal the cost of bank loans clearly rises. In effect the domestic borrower must pay the tax on the marginal foreign money. This has the effect of discouraging the transmission of the real effects of the interest rate change. So evidently a constant high reserve requirement has perverse effects. But an endogenous reserve requirement policy that increases reserve ratios as world rates fall succeeds in insulating the domestic loan market from the external shock. The "sterilization" policy succeeds not because it discourages international capital mobility but because it discourages domestic financial intermediation.

There are also the seeds of a banking system crisis in this model. The intuition is that the increasing tax of the capital controls falls on domestic loan rates. In turn, if the banks and the regulators are not careful only high risk borrowers will accept these terms. The key here is that we have set the stage so that capital controls work not through distorting traded asset returns as is typical in the standard model, but instead through distorting the cost of domestic financial intermediation. This distortion might limit the impact on domestic spending decisions as we have discussed here. But if the incentive for banks is to survive with negative net worth the same policies could fuel a speculative boom that more often than not will end in a bust.

References

- Banco Central de la Republica Argentina, 1996. "Principales Caracteristicas Del Marco Normativo Del Sistema Financiero Argentino," Area de Economia y Finanzas, Febrero.
- Bernanke, Ben S., "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression," American Economic Review, 73 (June 1983), 257-276.
- Bernanke, Ben S. and Alan S. Blinder, "Credit, Money and Aggregate Demand" American Economic Review, 78 (May 1988), 435-439.
- Bernanke, Ben S. and Mark Gertler, "Agency Cost, Net Worth, and Business Fluctuations," American Economic Review, 79, (March 1989), 14-31.
- Bernanke, Ben S. and Mark Gertler, "Financial Fragility and Economic Performance," Quarterly Journal of Economics Feb. 1990, 87-114.
- Bordo, Michael, 1996. Regulation and Bank Stability: Canada and the United States, 1870-1980, in *Reforming Finance: Some Lessons from History*, edited by Gerard Caprio, Jr. and Dimitri Vittas, Cambridge University Press, forthcoming.
- Bordo, Michael D., "The Lender of Last Resort: Some Historical Insights," NBER Working Paper No. 3011, June 1989.
- Bordo and Reddish, Journal of Economic History, 48 (2), June 1987, 401-417.
- Calomiris, Charles W. 1990. "Getting the Incentives Right in the Current Deposit Insurance System: Successes from the Pre-FDIC Era," mimeo, Northwestern University and Research Department, Federal Reserve Bank of Chicago.
- Calomiris, Charles W., "Deposit Insurance: Lessons for the Record," Economic Perspectives, Federal Reserve Bank of Chicago, May/June 1989, 10-30.
- Caprio, Gerard Jr. and Daniela Klingebiel, 1996. "Bank Insolvency: Macro Costs and Micro Cures," paper presented at the World Bank's Annual Bank Conference on Development Economics, and forthcoming in a conference volume.
- Chinn, Menzie, and Michael Dooley, 1995. "Asia-Pacific Capital Markets: Integration and Implications for Economic Activity," NBER Working Paper No. 5280, September.
- _____, 1995a. "Financial Repression and Capital Mobility: Why Capital Flows and Covered Interest Rate Differentials Fail to Measure Capital Market Integration," NBER Working Paper 5347, November.
- Cowan, Tyler, and Randall Kroszner, 1989. "Scottish Free Banking Before 1845: A Model for Laissez-Faire?" *Journal of Money, Credit, and Banking*, vol. 21, No. 2, May.
- Drazen, Allan, 1989. "Monetary Policy, Capital Controls, and Seigniorage in an Open Economy," in Marcello De Cecco and Alberto Giovannini, eds., A European Central Bank? Perspectives on Monetary Unification after Ten Years, Cambridge University Press.

- Englund, Peter and Lars E.O. Svensson, "Money and Banking in a Cash-in Advance Economy," International Economic Review 29, 1988, 681-705.
- Fischer, Stanley, "Seigniorage and the Case for National Money," Journal of Political Economy 90 (April 1982), 295-313.
- Fernandez, Roque R. and Pablo Guidotti, 1994. "Regulating the Banking Industry in Transition Economies: Exploring Interactions between Capital and Reserve Requirements," paper presented at Economic Reform: Latin America and the Transition Economies.
- Folkerts-Landau, David and Takatoshi Ito, International Capital Markets: Development, Prospects, and Policy Issues, IMF, Aug. 1995.
- Frankel, Jeffrey, and Chudozie Okongwu, 1995. "Liberalized Portfolio Capital Inflows in Emerging Markets: Sterilization, Expectations, and the Incompleteness of Interest Rate Convergence," International Journal of Finance and Economics, Vol. 1, No. 1, January.
- Freeman, S., "Banking as the Provision of Liquidity," Journal of Business 61 (1988), 45-64.
- Freris, Andrew F. 1991. *The Financial Markets of Hong Kong*, Routledge.
- Gertler, Mark, "Financial Structure and Economic Activity," Journal of Money, Credit and Banking, Nov. 1988, 559-588.
- _____, "Financial Capacity and Output Fluctuations in an Economy with Multi-Period Financial Relationships, Review of Economic Studies 59, 1992, 455-472.
- Gibbon, Robert, Game Theory for Applied Economists, Princeton University Press, 1992.
- Goodfriend, Marvin and Robert A. King, "Financial Deregulation, Monetary Policy, and Central Banking," in W.S. Haraf and R.M. Kushmeider (eds.), Restructuring Banking and Financial Services in America. American Enterprise Institute, Washington, D.C., 1989.
- Gorton, Gary, 1988. "Banking Panics and Business Cycles," Oxford Economics Papers, 40 (4), pp. 751-781, December.
- Greenfield, Robert L. and Leland B. Yeager, "A *Laissez-Faire* Approach to Monetary Stability," Journal of Money, Credit and Banking 15, August 1983, 302-315.
- Greenfield, Robert L. and Leland B. Yeager, "Can Monetary Disequilibrium be Eliminated?" Cato Journal 9, Fall 1989, 405-421.
- Grossman, Richard S., "Deposit Insurance, Regulation, and Moral Hazard in the Thrift Industry: Evidence for the 1930s," American Economic Review 82, Sept. 1992, 800-821.
- Guidotti, Pablo E., and Carlos A. Rodriguez, 1992. "Dollarization in Latin America: Gresham's Law in Reverse?" IMF Staff Papers, 39 (3), September, pp 518-544.
- Hanke, Steven H., Lars Jonung, and Kurt Schuler, 1993. Russian Currency and Finance: A Currency Board Approach to Reform, Routledge.

- Hong Kong Monetary Authority, Money and Banking in Hong Kong, 1995.
- Keeley, Michael C., "Deposit Insurance, Risk, and Market Power in Banking," American Economic Review, 80, Dec. 1980, 1183-1200.
- Kroszner, 1996. "Free Banking: The Scottish Experience as a Model for Emerging Economies," in *Reforming Finance: Some Lessons from History*, edited by Gerard Caprio, Jr. and Dimitri Vittas, Cambridge University Press, forthcoming.
- Kryzanowski, Lawrence and Gordon S. Roberts, 1993. "Canadian Banking Solvency, 1922-40," *Journal of Money, Credit, and Banking*, Vol. 25, No. 3, August (part 1).
- Jacklin, Charles J. and Sudipto Bhattacharya, "Distinguishing Panics and Information-based Bank Runs: Welfare and Policy Implications," Journal of Political Economy, 96 (3), June 1988, 568-592.
- Karaken, John H., "Federal Bank Regulatory Policy: A Description and Some Observations," Journal of Business 59, Jan. 1986, 3-48.
- Mishkin, Fredric S., "Preventing Financial Crises: An International Perspective," NBER Working Paper No. 4636, Feb. 1994.
- Myers, S. and N. Majluf, "Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have," Journal of Financial Economics, 13, 1984, 187-221.
- Pou, Pedro, 1995. "Liquidity: Some Ideas About Its Management," mimeo, Central Bank of Argentina, July.
- Rojas-Suarez, Liliana, and Steven R. Weisbrod, 1995. "Managing Banking Crises in Latin America: The Do's and Don'ts of Successful Bank Restructuring Programs," paper presented at *Banking Crises in Latin America*, Inter-American Development Bank, October.
- _____, 1995a. "Banking Crises in Latin America: Experience and Issues," paper presented at *Banking Crises in Latin America*, Inter-American Development Bank, October.
- Rolnick, Arthur J., and Warren E. Weber, 1986. "Gresham's Law or Gresham's Fallacy?" *Journal of Political Economy*, 94 (1), pp 185-99, February.
- Romer, Christina and David Romer, 1993. "Credit Channel or Credit Actions? An Interpretation of the Postwar Transmission Mechanism," NBER Working Paper No 4485, October.
- Savastano, Miguel A., 1996. "Dollarization in Latin America: Recent Evidence and Some Policy Issues," IMF Working Paper WP/96/4, January.
- Schwartz, Anna J., 1993. "Currency Boards: Their Past, Present, and Possible Future Role," *Carnegie-Rochester Conference Series on Public Policy*, 39 (0), December, pp 147-88.

- Shearer, Ronald A., John F. Chant, and David Bond, 1995. *Economics of the Canadian Financial System: Theory, Policy, and Institutions*, Prentice Hall.
- Stein, Jeremy C., "An Adverse Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy," NBER Working Paper No. 5217, Aug. 1995.
- Wheelock, David C. and Subal C. Kumbhakar, "Which Banks Choose Deposit Insurance? Evidence of Adverse Selection and Moral Hazard in a Voluntary Insurance System," Journal of Money, Credit and Banking 27 (1), Feb. 1995, 187-201.
- Whitesell, William C., "Deposit Banks and the Market for Payment Media," Journal of Money, Credit and Banking 24, Nov. 1992, 483-498.
- Williamson, Stephen, "Costly Monitoring, Optimal Contracts, and Equilibrium Credit Rationing," Quarterly Journal of Economics, Feb. 1987.

NOTES

- 1 This ratio was derived from data in Freris (1991, page 20) and the Honk Kong Monetary Authority, 1995
- 2 There is some controversy over how safe the Canadian system really was. During the 1920s and 1930s, when 15000 banks disappeared in the United States, only one closed in Canada. However, it has been argued (Kryzanowski and Roberts, 1993) that many of the largest Canadian banks were insolvent but remained open with implicit deposit insurance during the 1930s. Still, the strength of the Canadian system was that with a small number of banks, it was possible for the government to ensure that it was only covering non-diversifiable risk, and indeed losses did not grow, as with most cases of keeping bust banks open. All the major Canadian banks emerged intact from the depression, and they appear to have mitigated, rather than magnified, the large macro disturbance.
- 3 Calomiris (1990) reports that once the number of banks was over 40, the incentive to monitor appeared to weaken, as the costs from any failure were more easily spread.
- 4 Market participants do not expect the value of assets to remain constant but since further increases or decreases are equally likely the expected value is permanently reduced.
- 5 To avoid the emergence of a dual foreign exchange market, the currency board would have to close the banks and distribute the assets to depositors. For reasons discussed below, the liquidation of an entire banking system is probably too costly to be seriously entertained.
- 6 See Bennett (1994) for an excellent review of recent experience with currency boards in Hong Kong, Argentina and Estonia.
- 7 These general problems of adverse selection and moral hazard serve to define many aspects of credit markets. As Mishkin (1994) emphasizes, many of the characteristic properties associated with financial markets such as debt contracts, the reliance on security issues for funding only by large nonfinancial firms, collateral, financial intermediaries and the traditionally high degree of financial market regulation, all arise from the problems asymmetric information generates. One important implication of the informational problems common to financial markets is the potential importance they give to noninterest rate factors and quantities in determining investment activity. The volume of credit, and the level of investment, will depend not just on interest rate levels but on the asset base of the banking sector as well.
- 8 The “sunspot” view was first formally modeled by Diamond and Dybvig and subsequently extended by and Cooper and Ross among others. In Diamond and Dybvig (1983), deposit runs result from changes in the intertemporal consumption preferences of depositors and are unrelated to the underlying value of the banking sector’s assets. Banks engage in maturity transformation, investing deposits in both long-term, illiquid assets and lower yielding liquid assets. If depositors, as a result of purely exogenous factors, decide to consume before the long-term asset has matured, banks have insufficient holdings of liquid assets to meet withdrawals and must attempt to liquidate their long-term assets at a loss. These models of banking panics incorporate some of the key aspects of modern banking. For example, Cooper and Ross (1992) stress the role that the possibility of panics has on the lending behavior of banks and the form of the deposit contract they offer to depositors. See also Freeman (1988).
- 9 Mishkin (1994, p. 9) lists five factors promoting financial crises. These are: 1) increases in interest rates; 2) stock market declines; 3) increases in uncertainty; 4) bank panics; 5) unanticipated declines in inflation. Interestingly, none (with the possible exception of number 4) deal with contagion effects arising initially from the failure of a single or small number of banks. Bordo (1989) distinguishes between factors leading to panics according to whether they are “internal” - arising from poor management, poor judgment, or dishonesty - and those that are “external” - arising from changes in relative prices and the overall price level. However, this fails to include the possibility of panics arising from contagion effects. That is, situations in which a well managed bank might suffer a depositor run as a result of the failure of some other bank.
- 10 The uniqueness of banks has been argued from two quite different perspectives. In what until recently had been the dominate view, banks are special, and therefore the potential for bank failures requires public policy

involvement, because their liabilities form a major fraction of the medium of exchange. That is, the critical role of banks in the payments system makes them special. Since it is their liabilities that are used for payments, this view focuses on the liability side of the banking sector and the implications of banking failures for the supply of money. Specifically, banking sector risks, to the extent that they potentially lead to runs on banks that disrupt the payments system, can lead to large economic dislocations. Bordo (1989) illustrates this money view in arguing that “The need for a lender of last resort arises in a fractional reserve banking system when a banking panic, defined as a massive scramble for high powered money, threatens the money stock, and hence the level of economic activity (*italic added*). The lender of last resort can allay an incipient panic by timely assurance that it will provide whatever high powered money is required to satisfy the demand, either by offering liberal access to the discount window at a penalty rate or by open market purchases.” Bordo (1989, p. 1).

In this view then, the necessity of developing policies that ensure against large scale banking failures arises from the impact such failures would have on the money stock and the payments mechanism. And the traditional role of the LOLR is to provide an elastic supply of high powered money by lending to otherwise solvent banks facing depositor runs.

A more recent view has focused on the asset side of banks and their role in providing credit. Example of this view can be found in Bernanke (1983), Bernanke and Gertler (1989), or Williamson (1987); an excellent summary can be found in Gertler (1988). Building on advances in the economics of imperfect and asymmetric information, banks are viewed as playing a special role in overcoming problems of adverse selection and moral hazard in credit markets. In particular, banks are viewed as having a comparative advantage in monitoring borrowers, particularly small borrowers, who are engaged in risky activities.

Adverse selection is a particular problem in credit markets since potential borrowers are likely to have better information about their investment plans and the likelihood of their success than do outside observers. Thus, any lender will need to engage in monitoring activities, and the cost of such monitoring may make lending unprofitable. A higher interest rate does not necessarily make such lending profitable, since the pool of potential borrowers will change as interest rates rise. Higher rates may simply attract a riskier pool of borrowers and actually lower the lenders’ expected return. Under these circumstances, there may be no interest rate that balances supply and demand, leaving some borrowers unable to obtain financing even though they may have projects whose expected return exceeds the cost of funds.

If banks have a comparative advantage in monitoring borrowers, perhaps because of localized informational advantages or because they service the borrower’s transaction account, banks may be able to supply credit to borrowers who would otherwise be unable to obtain financing. A disruption of lending activity by the banking industry would therefore have adverse effects on real economic activity.

In this credit view, alternative sources of funding for investment activity are imperfect substitutes for bank lending. Any contraction of the banking sector’s ability to grant credit, therefore, forces borrowers to turn to other sources of funds or some borrowers may not have access to funding sources. As a result, the level of capital formation is reduced, with subsequent impacts on the level of economic activity. Thus, by directly affecting the efficiency of the financial system in funding productive investment projects, banking runs are likely to generate persistent adverse effects on real economic activity.

¹¹ This section draws on Chinn and Dooley (1995a).

¹² In the more familiar model the demand for reserves changes with money demand because money holders shift to assets that carry lower reserve requirements.

¹³ However, it should be noted that supposedly irrevocably fixed exchange rates (Bretton Woods, the CFA Franc Zone) or common currency areas have not proved to be robust -- or even to get off the ground (EMS) -- in the absence of either significant fiscal transfers or, in their absence, an irrevocable commitment on the part of surplus areas to expand.

¹⁴ This point is contested in the U.S.: proponents of interstate (and in former times, or unit) banking argued that larger banks from other regions would take over smaller banks and then lend less to local firms, in part due

to inferior information. However, if there are local branches, then there remains a point at which local information can be collected (and technology increasingly reduces the costs associated with gathering information from a distance). The issue may turn on incentives: can distant managers be motivated to respond prudently on the basis of local information. Foreign banks also regularly enjoy a diversification over domestic banks; thus even if, all other things equal, Mexican banks today would be more likely to lend in Mexico given the same information, their previous concentration on Mexican assets has so weakened their portfolios that such a recovery is unlikely.

¹⁵ Such alliances imply that the foreign bank has a fairly accurate view of the portfolio quality of the Argentine bank and thus is more willing to accept assets in a crisis. Formal lines of credit or contingent lines all suffer from the "adverse materiality" clauses, which might be invoked, for example, if there were changes in the political constellation which were seen to affect expectations, even if the financial indicators were unchanged. Thus, lenders may charge a lot for contingent lines, but they may not actually be available in a systemic crisis. The alternative of formal linkages among banks, particularly in cases such as the Mexico-induced crisis of confidence, might be more effective in providing immediate liquidity. Of course these alliances are more likely for larger banks, and in general if one believes that risks are better diversified and capital more easily raised for larger banks, then the consolidation of Argentine banks in recent years may well lead to banks better able to fend for themselves.

¹⁶ The April 1995 revision to the Law on Financial Entities contains in Article 35 bis on restructuring sweeping powers for the BCRA in defense of depositors, including the exclusion of assets and liabilities and transfer of same to other financial entities. The law also allows the BCRA to provide rediscounts for longer than 30 days and for accounts larger than the bank's net worth in extraordinary circumstances.

¹⁷ See Corrigan (1996) for an assessment of the Argentine banking system and recommendations for reform.

¹⁸ Their work forms the basis of the model developed by Stein (1994) as well.

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